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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,456	10/31/2003	David Champion	100200584-1	9588

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EXAMINER	
ONEILL, KARIE AMBER	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
04/16/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/699,456	CHAMPION ET AL.	
	Examiner	**Art Unit**	
	Karie O'Neill	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 30 January 2009.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20,48,49 and 68-72 is/are pending in the application.

4a) Of the above claim(s) 5, 7-11 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-4, 6, 12-20, 48-49, 68-72 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Request for Continued Examination

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 30, 2009, has been entered.

2. Claims 1, 16-19, 48, 49 and 72 have been amended. Claims 5 and 7-11 have been withdrawn from consideration. Therefore, Claims 1-4, 6, 12-20, 48, 49 and 68-72 are pending in this office action.

Claim Rejections - 35 USC § 112

3. The rejection of Claims 1-4, 6, 12-20, 48, 49, and 68-72, under 35 U.S.C. 112, second paragraph, has been overcome based on the arguments presented on pages 7-8 of the Remarks dated January 12, 2009.

Claim Rejections - 35 USC § 102

4. The rejection of Claims 1-4, 6, 12-13, 15-20, 48, 49 and 68-71, under 35 U.S.C. 102(b) as being anticipated by Seabaugh et al. (US 2003/0027033 A1), is overcome based on the amendments to the claims.

5. The rejection of Claims 1-3, 6, 12-16, 18-20, 48, 49 and 68-71 under 35 U.S.C. 102(b) as being anticipated by Huang et al. (US 2002/0098406 A1), has been overcome based on the amendments to the claims.

Claim Rejections - 35 USC § 103

6. The rejection of Claim 72 under 35 U.S.C. 103(a) as being unpatentable over Seabaugh et al. (US 2003/0027033 A1), in further view of Monty et al. (US 6,849,911 B2), has been overcome based on the amendments.

7. The rejection of Claim 72 under 35 U.S.C. 103(a) as being unpatentable over Huang et al. (US 2002/0098406 A1), in further view of Monty et al. (US 6,849,911 B2), has been overcome based on the amendments.

Rejections

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1-4, 6, 12, 15-20, 48, 49 and 68-71 rejected under 35 U.S.C. 103(a) as being unpatentable over Seabaugh et al. (US 2003/0027033 A1) in view of Zhou et al. (US 2003/0180472 A1).

With regard to Claims 1-3, 20, 48, 49 and 71, Seabaugh et al. discloses a solid oxide fuel cell in which power is generated by the transport of ions through an

electrolyte membrane sandwiched between electrodes (paragraph 0003). The electrolyte acts as a substrate for a ceramic electrode, the ceramic electrode comprising a mixture of two or more components including at least one nano-scale ionically conducting ceramic electrolyte material and at least one nano-scale powder of an electrode material (paragraph 0002). The electrode/electrolyte material mixture is established on either side of the electrolyte material when forming the fuel cell. The electrode/electrolyte material mixture is made up of the mixture of electrolyte nanoparticles and electrode material nanoparticles being mixed together with a liquid surfactant material that will surround and contain the powdered mixture. The plurality of nanoparticles enhances catalytic activity of the electrode as the oxygen molecules from air are converted to oxygen ions at the air electrode and these oxygen ions react with hydrogen and carbon monoxide to form water and carbon dioxide at the fuel electrode (see paragraphs 0003-0004 and Claims 1-25). Seabaugh et al. also discloses wherein the fuel cell is device for generating power which is supplied to external devices or a load.

Seabaugh et al. does not disclose wherein the film established on the substrate is a patterned film including soluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, at least one of the plurality of nanowires contacting at least an other of the plurality of nanowires. The term “imaged photoresist” describes a process in which a patterned film is formed on a substrate. Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. “Even though product-by-process claims are limited by and defined by the

process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." Therefore, the end product of insoluble matter established as a patterned film on a substrate is given weight, but the term "imaged photoresist" is not given patentable weight with regard to the process.

Zhou et al. discloses a method for assembling nano-objects into patterned structures onto a supporting surface. These nano-object structures are useful in a variety of devices including fuel cells (paragraph 0018). The nano-objects include nanoparticles, nanotubes, nanorods or nanowires having a dimension that is less than 1 micron in at least one direction (paragraph 0004). Zhou et al. discloses in Figures 8A and 8B and paragraphs 0061-0063, an electrode for use in a fuel cell comprising a multi-layer structure. The first layer is formed from self-assembled carbon nanotubes (810A, 840) which are deposited on a conducting surface (830). The second layer (820A, 850) is an electrolyte material deposited over the self-assembled carbon nanotubes using any suitable technique. The term "self-assembled" implies that the nanotubes will contact at least an other of the nanotubes and inherently will increase the number of sites per unit volume in which catalysis takes place. In Figure 9A and paragraphs 0065-0066, Zhou et al. discloses the method of making the patterned substrate by spin-coating a thin layer of photoresist on a substrate and submersing it into a solution of nano-objects/water, wherein when the water evaporates the nano-

objects, or insoluble material of the photoresist, are present. This method can be used to make the multi-layer nano-object structures for use in the fuel cell electrodes of Figures 8A and 8B. Therefore, based on the teachings of the references, it would have been obvious to one of ordinary skill in the art to use a patterned film, including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, on the substrate of the fuel cell of Seabaugh et al., because Zhou et al. teaches that imaged photoresist techniques can form an electrode for use in a fuel cell in a variety of patterns including squares, circles, dots or any other geometry that can be patterned and the process forms multilayer structures with a desired thickness and desired number of repeating layers.

With regard to Claim 4, Seabaugh et al. discloses wherein the electrolyte is at least one of yttrium-stabilized zirconia, gadolinium-doped ceria, a doped ceria electrolyte material, barium zirconate, scandium doped zirconia, a lanthanum gallate based ceramic electrolyte material, a bismuth oxide based electrolyte materials (paragraph 0051). Gadolinium-doped ceria is formed as a single phase with a cubic fluorite structure as is evidenced by Godinho in Influence of Microwave Heating on the Growth of Gadolinium-Doped Cerium Oxide Nanorods on page 384.

With regard to Claims 6, 12 and 15-19, Zhou et al. discloses wherein the nanowires are formed from an electrolyte filament material (paragraph 0061) and wherein the patterned film comprises an electrode (840, 860), which is either a cathode or anode (Figure 8B). Zhou et al. discloses wherein the nanowires are “self-assembled” meaning that they are randomly oriented throughout the patterned film and have a

diameter between 0.4nm and 50 nm and a length between 0.1μm and 100μm (paragraph 0013). It would have been obvious to one of ordinary skill in the art to use nanowires randomly oriented throughout the patterned film of a the cathode of Seabaugh et al., because Zhou et al. teaches the nanowires have exceptional mechanical properties with high elastic modulus, high ductility, high electrical and high thermal conductivity, thermal stability and chemical stability (paragraph 0013). These features, especially high electrical conductivity and thermal and chemical stability are essential for fuel cell applications.

With regard to Claim 68, Seabaugh et al. discloses that the ceramic electrode material formed by mixing at least one nano-scale ionically conductive ceramic electrolyte material and at least one nano-scale powder of an electrode material, are useful in fuel cells. Zhou et al. discloses the patterned film including insoluble matter of an imaged photoresist, for use in fuel cells. The combined fuel cell of Seabaugh et al. and Zhou et al. and the instant application have the same structural features and the ceramic electrode material can be used in the same type of fuel cell.

With regard to Claims 69-70, Zhou et al. discloses in Figures 8A and 8B, wherein the plurality of electrolyte filament carbon nanowires (810A, 840) is deposited on a substrate (830) and subsequently coated by a second material (820A, 850) of polymers, metals, ceramics, semiconductors, inorganic materials, organic materials or the like (paragraph 0061). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the nanowires with cathode material nanoparticles in the fuel cell of Seabaugh et al., because Zhou et al. teaches forming a multilayer

structure with a desired thickness having high mechanical strength that can be used in a fuel cell (paragraphs 0061-0063). Further, Zhou et al. teaches the nanowires have exceptional mechanical properties with features, such as high electrical conductivity and thermal and chemical stability that are essential for fuel cell applications.

With regard to Claim 72, Zhou et al. discloses wherein the imaged photoresist is a negative photoresist or a positive photoresist. Zhou et al. discloses that a photo mask with periodic lines is placed on top of the surface coated with the photoresist. After placement of the photo mask, an ultraviolet light source is used to expose the surface. The developed glass forms a patterned substrate with periodic hydrophobic regions which are covered by the photoresist and hydrophilic regions which are free of the photoresist (paragraph 0065). It would have been obvious to one of ordinary skill in the art to make the imaged photoresist a negative photoresist or a positive photoresist in the fuel cell of Seabaugh et al., based on the desired fuel cell application, such as an anode catalyst layer or a cathode catalyst layer. Further, Zhou et al. teaches a process of forming patterns in any geometry or hydrophilicity or hydrophobicity as needed (paragraph 0066).

10. Claims 1-3, 6, 12-20, 48, 49 and 68-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al. (US 2002/0098406 A1) in view of Zhou et al. (US 2003/0180472 A1).

With regard to Claims 1-3, 20, 48, 49 and 71, Huang et al. discloses a solid oxide fuel cell for automotive and other applications (paragraph 0008), comprising: a substrate

made of an electrolyte (Example 1); an inherently patterned paste made up of a plurality of well-dispersed nano-sized particles of electrocatalytic noble metals and ceramic ionic conducting particles mixed with a suitable binder and a suitable solvent, the plurality of well-dispersed nano-sized particles established on the electrolyte substrate and increasing the number of sites which enhance catalytic activity (paragraphs 0020-0023, 0043).

Huang et al. does not disclose wherein the film established on the substrate is a patterned film including soluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, at least one of the plurality of nanowires contacting at least an other of the plurality of nanowires. The term “imaged photoresist” describes a process in which a patterned film is formed on a substrate. Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. “Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” Therefore, the end product of insoluble matter established as a patterned film on a substrate is given weight, but the term “imaged photoresist” is not given patentable weight with regard to the process.

Zhou et al. discloses a method for assembling nano-objects into patterned structures onto a supporting surface. These nano-object structures are useful in a

variety of devices including fuel cells (paragraph 0018). The nano-objects include nanoparticles, nanotubes, nanorods or nanowires having a dimension that is less than 1 micron in at least one direction (paragraph 0004). Zhou et al. discloses in Figures 8A and 8B and paragraphs 0061-0063, an electrode for use in a fuel cell comprising a multi-layer structure. The first layer is formed from self-assembled carbon nanotubes (810A, 840) which are deposited on a conducting surface (830). The second layer (820A, 850) is an electrolyte material deposited over the self-assembled carbon nanotubes using any suitable technique. The term “self-assembled” implies that the nanotubes will contact at least an other of the nanotubes and inherently will increase the number of sites per unit volume in which catalysis takes place. In Figure 9A and paragraphs 0065-0066, Zhou et al. discloses the method of making the patterned substrate by spin-coating a thin layer of photoresist on a substrate and submersing it into a solution of nano-objects/water, wherein when the water evaporates the nano-objects, or insoluble material of the photoresist, are present. This method can be used to make the multi-layer nano-object structures for use in the fuel cell electrodes of Figures 8A and 8B. Therefore, based on the teachings of the references, it would have been obvious to one of ordinary skill in the art to use a patterned film, including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, on the substrate of the fuel cell of Seabaugh et al., because Zhou et al. teaches that imaged photoresist techniques can form an electrode for use in a fuel cell in a variety of patterns including squares, circles, dots or any other geometry that can

be patterned and the process forms multilayer structures with a desired thickness and desired number of repeating layers.

With regard to Claims 6, 12 and 15-19, Zhou et al. discloses wherein the nanowires are formed from an electrolyte filament material (paragraph 0061) and wherein the patterned film comprises an electrode (840, 860), which is either a cathode or anode (Figure 8B). Zhou et al. discloses wherein the nanowires are “self-assembled” meaning that they are randomly oriented throughout the patterned film and have a diameter between 0.4nm and 50 nm and a length between 0.1μm and 100μm (paragraph 0013). It would have been obvious to one of ordinary skill in the art to use nanowires randomly oriented throughout the patterned film of a the cathode of Huang et al., because Zhou et al. teaches the nanowires have exceptional mechanical properties with high elastic modulus, high ductility, high electrical and high thermal conductivity, thermal stability and chemical stability (paragraph 0013). These features, especially high electrical conductivity and thermal and chemical stability are essential for fuel cell applications.

With regard to Claims 13-14, Huang et al. discloses wherein the inherently patterned paste comprises a cathode, wherein the plurality of nano-sized electrocatalytic noble metal particles are metallic components of cathode material (Example 1), and wherein the cathode metallic comprise at least one of platinum, palladium, rhodium, silver, ruthenium, gold, iridium, osmium or combinations or mixtures thereof (paragraph 0030).

With regard to Claim 68, Huang et al. discloses an inherently patterned paste made up of a plurality of well-dispersed nano-sized particles of electrocatalytic noble metals and ceramic ionic conducting particles being useful in fuel cells. Zhou et al. discloses the patterned film including insoluble matter of an imaged photoresist, for use in fuel cells. The combined fuel cell of Huang et al. and Zhou et al. and the instant application have the same structural features and can be used in the same type of fuel cell. Applicant is advised to submit other information in regard to a single chamber fuel cell if it is shown to be patentably distinct to the invention.

With regard to Claims 69-70, Zhou et al. discloses in Figures 8A and 8B, wherein the plurality of electrolyte filament carbon nanowires (810A, 840) is deposited on a substrate (830) and subsequently coated by a second material (820A, 850) of polymers, metals, ceramics, semiconductors, inorganic materials, organic materials or the like (paragraph 0061). It would have been obvious to combine the nanowires with cathode material nanoparticles in the fuel cell of Huang et al., because Zhou et al. teaches forming a multilayer structure with a desired thickness having high mechanical strength that can be used in a fuel cell (paragraphs 0061-0063).

With regard to Claim 72, Zhou et al. discloses wherein the imaged photoresist is a negative photoresist or a positive photoresist. Zhou et al. discloses that a photo mask with periodic lines is placed on top of the surface coated with the photoresist. After placement of the photo mask, an ultraviolet light source is used to expose the surface. The developed glass forms a patterned substrate with periodic hydrophobic regions which are covered by the photoresist and hydrophilic regions which are free of the

photoresist (paragraph 0065). It would have been obvious to one of ordinary skill in the art to make the imaged photoresist a negative photoresist or a positive photoresist in the fuel cell of Huang et al., because Zhou et al. teaches a process of forming patterns in any geometry or hydrophilicity or hydrophobicity as needed (paragraph 0066).

Response to Arguments

11. Applicant's arguments with respect to claims 1-4, 6, 12-20, 48, 49 and 68-72 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karie O'Neill whose telephone number is (571)272-8614. The examiner can normally be reached on Monday through Friday from 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark Ruthkosky/
Primary Examiner, Art Unit 1795

Karie O'Neill
Examiner
Art Unit 1795

KAO